(* COUNTS *)

30z

Diagonal Analysis

		Exh.	Page
Introduction	30z-1		
		A	
30zA.	Analyzing for a diagonal 30z-1	1	30z-2/4
	- absent the diagonal 30z-5	B	
	- approach three 30z-6	2	30z-8/10
		3	30z-11
		C	
30zB.	Residuals? Clarity? 30z-7	4	30z-14/16
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		6	30z-19/20
30zC.	Migration and Mobility 30z-12	7	30z-21
	- a mobility example 30z-13	8	30z-23/24
	- European mobility 30z-22	9	30z-25
		H	
	**********	P	
		10	30z-28
30zH.	How far have we come? 30z-26	11	30z-29
		12	30z-30
	**********	13	30z-31/32
		14	30z-33
30zP.	Problems for chapter 30z 30z-27		

30z

Diagonal Analysis

As we have now seen examples, some two-way tables have honest diagonals because some -- or all -- of the row labels also appear as column labels. Any cell whose row and column labels are the same is a diagonal cell. Diagonal cells are often different from off-diagonal cells. We often want to allow explicitly for this difference.

If we are to do anything, the least we can do is to make a common (uniform) allowance for being on the diagonal rather than off it.

If it is called for with sufficient strength, we can make different allowances for each diagonal cell.

Intermediate choices are possible, but do not seem too likely.

30zA. Analyzing for a diagonal

Let us turn back to the eye-color example and exhibit 10 of chapter 33. Panel A of exhibit 1 repeats the data and a resistant columns-plus-rows analysis. Panel B isolates the diagonal residuals, all of which are positive. Since these diagonal values were present during the columns-plus-rows analysis, we should expect a compensating negative shift off-diagonal. We can assess this shift (somewhat roughly) from the

exhibit 1 of chapter 30z -- eye color

Three approaches to a diagonal analysis

----------(approach one)----------

A) The DATA and an ordinary ANALYSIS -- see exhibit 10 of chapter 30, unit 0.01

Son's eye color	Father's eye color				analysis by midmean differences				
	1	2	3	4	1	2	3	4	eff
1	229	185	161	148	45	4	-7	-11	-4
2	192	209	161	156	4	24	-11	-7	8
3	140	153	174	136	-17	-1	33	4	-23
4	175	156	163	204	0	-16	4	54	-5
eff					10	7	-6	-15	170

B) The DIAGONAL RESIDUE of the analysis of panel A

observed	median of off-diagonal values	differences
45		49
24		28
33	-4	37
54		58

(cont'd.)

exhibit 1 (cont'd.)

----------(approach two)----------

C) The DATA with DIAGONAL VALUES SUPPRESSED

	Data				analysis by median polish, 3 half-cycles				
	1	2	3	4	1	2	3	4	eff
1	a	185	161	148	abs	20	0	0	0
2	192	a	161	156	9	abs	-8	0	8
3	160	153	a	136	-23	0	abs	0	-12
4	175	156	163	a	0	-9	2	abs	0
eff					12	2	-2	-15	163

C) The FIT of panel C and the DIAGONAL RESIDUE

	fit				diagonal residue			
	1	2	3	4	1	2	3	4
1	175	165	161	148	54			
2	183	173	169	156		36		
3	163	153	149	136			25	
4	175	165	161	148				56

(cont'd.)

exhibit 1 (cont'd.)

----------(approach three)----------

E) ANALYSIS by MEDIAN DIFFERENCES of panel C

offdiagonal residuals				fit				diagonal residue			
1	2	3	4	1	2	3	4	1	2	3	4
a	8	-3	-7	180	177	164	155	49			
8	a	-7	-3	184	181	168	159		28		
-13	3	9	8	153	150	137	128			37	
4	-12	8	a	171	168	155	146				58

F) PROBLEMS

1) Analyze the left-hand table of panel C by median polish, starting with columns, showing that this leads to the analysis on the right of that panel.

2) Analyze the same data by median differences, showing that this leads to the tables of panel B.

off-diagonal residuals, most simply by finding their medians. A rough adjustment for the effects of the diagonal values in distorting the columns-plus-rows analysis is to subtract this median from the diagonal residuals, as panel B does. We can take the results

49, 28, 37 and 58

as a four-different-value fit to the four diagonal cells, or we can take their median

43

as the common-diagonal-value fit to the same four cells.

This procedure is simple, particularly once the columns-by-rows analysis is at hand. We have to recognize that it is a little crude.

* absent the diagonal *

We now open a less crude approach. The simplest way to keep the diagonal contributions from affecting the columns-plus-rows fits is to treat the diagonal values as absent. Panel C (of exhibit 1) does just this, proceeding by median polishing to a columns-plus-rows analysis for the off-diagonal values. The fit, as panel D illustrates, is defined for both off-diagonal and diagonal cells. Thus we can get a new diagonal residue, this time from

diagonal residue = diagonal data - diagonal fit

where the diagonal fit is based only on off-diagonal values.

This time the four diagonal residuals are

54, 36, 25 and 56

and their median is

45

not very different from before.

The only crudity of this analysis is the non-uniqueness of median polishing. Only rather rarely need we let this concern us seriously.

* approach three *

Panel E starts in the same way as panel C -- setting aside the diagonals. To provide uniqueness and other goodies it goes to the trouble of using median differences to analyze the incomplete two-way table. All else stays the same.

Interestingly enough, in this particular example, the careful median-difference approach produces just the same set of diagonal values as the first approach. We need not expect this to happen always.

30zB. Residuals? Clarity?

What residuals should we take seriously in such analyses? A bit of thought here can improve our answer. If we are to make a four-different-value fit, we can guarantee to leave nothing on the diagonal. It is not sensible for us to consider that "residuals of zero" are left on the diagonal. Nothing identically and inevitably zero helps us much as a residual.

For four-different-value fits then, we ought look only at off-diagonal residuals, as in panel A of exhibit 2.

For single-diagonal-value fits, we can -- and should -- look at all residuals, as in panel B.

Panel C compares the fits, using the choice -- adjust or don't adjust -- for the second approach whose clarity resembles most those of the other two approaches. Clearly diagonal fitting helps.

Since the single-diagonal-constant fits come close to attaining the clarity of the four-diagonal constant fits, we will probably want to economize on loss of degrees of freedom and stop with a single-constant diagonal fit in this example.

* format *

We need to give some thought to how we write down our diagonal analyses, once completed. Exhibit 3 shows two prototypes which at least meet minimal requirements.

exhibit 2 of chapter 30z -- eye color

Looking at the quality of diagonally fitted tables

A) RESIDUALS, MIDSPREADS, and CLARITY for FOUR-DIFFERENT-VALUE FITS -- unit still 0.01

approach one

a	4	-7	-11
4	a	-11	-7
-17	-1	a	4
0	-16	4	a

Hinges of residuals: -11 and +4. Midspread: 15

Clarity: 6.5 = (229 - 132) / 15

approach two

a	20	0	0
9	a	-8	0
-23	0	a	0
0	-9	2	a

Hinges of residuals: -4 and +1. Midspread: 5
(Same adjusted*): -8h and +5h. Midspread: 14

Clarity: 18.6 = (229 - 136) / 5
(Adjusted): 6.7 = (229 - 136) / 14

*With 4 of the zero residuals set aside as inevitably zero (at variable locations).

approach three

a	8	-3	-7
8	a	-7	-3
-13	3	a	8
4	-12	8	a

Hinges of residuals: -7 and +8. Midspread: 15

Clarity: 6.7 = (229 - 128) / 15.

(cont'd.)

exhibit 2 (cont'd.)

B) RESIDUALS, MIDSPREADS, and CLARITY for SINGLE-DIAGONAL-VALUE FITS

approach one

2	4	-7	-11
4	-19	-11	-7
-17	-1	-10	4
0	-16	4	11

Hinges of residuals: -11 and +4. Midspread: 15.

Clarity: 6.3 = (227 - 132) / 15.

Examples: 2 = 45 - 43, -19 = 24 - 43, where 43 is median of adjusted diagonal residuals.

approach two

9	20	0	0
9	-9	-8	0
-23	0	-20	0
0	-9	2	11

Hinges of residuals: -8h and 5h. Midspread: 19.
(same adjusted*): -9 and 9. Midspread: 18.

Clarity: 6.0 = (220 - 136) / 14.
(Adjusted): 4.7 = (220 - 136) / 18.

*See note in panel A.

Examples: 9 = 54 - 45, -9 = 36 - 45, etc. where 45 is the median of 45, 36, 25 and 56.

approach three

6	8	-3	-7
8	-15	-7	-3
-13	3	-6	8
4	-12	8	15

Hinges of residuals: -7 and 8. Midspread: 15.

Clarity: 6.3 = (223 - 128) / 15.

(cont'd.)

exhibit 2 (cont'd.)

C) COMPARISON of ANALYSES

type of analysis		degrees of freedom left	clarity	$(\text{clarity})^2(\text{df})$
columns-plus-rows only		9	2.4	51
4-diag	approach one	5	6.5	210
	approach two		6.7	225
	approach three		6.7	225
1-diag	approach one	8	6.3	315
	approach two		6.0	285
	approach three		6.3	315

exhibit 3 of chapter 30z -- eye color

Examples of Writing down the diagonal analysis

A) The MEDIAN DIFFERENCE ANALYSIS with ONE diagonal constant

	1	2	3	4	eff
1	6	8	-3	-7	5
2	8	-15	-7	-3	9
3	-13	3	-6	8	-22
4	4	-12	8	15	4
eff	9	6	-5	-16	166

To each DIAGONAL cell
ALSO ADD 43

B) The MEDIAN DIFFERENCE ANALYSIS with FOUR diagonal constants

	1	2	3	4	eff
1	(0)	8	-3	-7	5
2	8	(0)	-7	-3	9
3	-13	3	(0)	8	-22
4	4	-12	8	(0)	4
eff	9	6	5	-16	166

1	2	3	4
49			ADD TO FIT
	28		
ADD TO FIT		37	
			58

C) PROBLEMS

1. Construct these two corresponding tables for the analyses by the second approach.

2. Do the same for the first approach.

30zC. Migration and Mobility

The comparison of one situation of something with another similar situation generates most of the tables of counts that have row tags matched to column tags. Often, as in the eye color example, there is a progression from one to the other -- there from father to son.

Migration -- change of residence -- offers many examples. Here the step could be a generation, too, but more often it is a step from one date to another for a single person. As these dates come closer together, fewer people will have moved. As a result more and more counts will lie on the diagonal -- the distinction between diagonal and off-diagonal cells will become greater and greater. There will be more reason to look for an analysis that does not treat columns and rows symmetrically -- at least as something to be compared with the symmetric analyses.

There are special situations. In 19th century North America, for example, migration was in large part from East to West. Analyses using ordered versions could make good sense. As always with two ordered factors -- if we are willing to stretch the notion of "response" a little -- the natural first step would be finding the double flogs. What might a diagonal analysis then do for us?

Rather than trying this out for migration, we shall turn to occupational mobility -- specifically to the relation between father's occupation and son's occupation.

* a mobility example *

In 1953, Rogoff published data on the combinations of father's occupation and son's occupation for a sample of about 10,000 sons observed in Indianapolis in 1940. For our purposes, we shall condense the original classification somewhat, and will omit "protective service", "personal service" and "farming" as occupational categories about whose relative position there might well be dissent.

The classification that we shall use is given in panel A of exhibit 4. The calculation of the double flogs proceeds as before. Since the same cutting points are used for both father and son, any analysis will have a meaningful diagonal. The elementary analysis of panel H is quite clear and straightforward:

- effects are small -- and irregular -- for both rows and columns.
- residuals are small except on the diagonal and in the extreme upper right corner.

Exhibit 5 does the simple diagonal analysis using median differences. As panel B shows the diagonal fit, if made, would be positive in every diagonal cell, but large only in the $\alpha\alpha$ and $\delta\delta$ cells.

exhibit 4 of chapter 30z -- Indianapolis mobility

Mobility between generations in Indianapolis

A) CLASSIFICATION

Cut label	Used here	Includes from Rogoff
α	PROF	Professional Semi-professional
β	PROP	Proprietors, managers, and officials
γ	CLER	Clerical and sales
δ	SKIL	Skilled Semi-skilled
	UNSK	Unskilled

B) CELL COUNTS -- cutting points are labelled, not classes

Father's occupation	Son's occupation α	β	γ	δ	
α	204	40	152	159	15
β	133	212	368	410	30
γ	141	83	461	344	26
δ	237	180	782	2550	235
	28	20	94	327	206

C) CUMULATED COUNTS

Father's occupation	Son's occupation above α	β	γ	δ	All
above α	204	244	396	555	(570)
β	337	589	1109	1678	(1723)
γ	478	813	1794	2707	(2778)
δ	715	1230	2993	6456	(6762)
(All)	(743)	(1278)	(3135)	(6925)	7437

exhibit 4 (Cont'd.) - 2

D) INVERTED CUMULATIONS

Father's occupation		Son's occupation above α	β	γ	δ	All
(All)		(743)	(1278)	(3135)	(6925)	
below	α	539	1034	2739	6370	(6867)
	β	406	689	2026	5247	(5714)
	γ	265	465	1341	4218	(4659)
	δ	28	48	142	469	(675)

E) %s for CUMULATED COUNTS

Father's occupation		Son's occupation above α	β	γ	δ
above	α	35.8%	42.8%	69.5%	97.1%
	β	19.5	34.1	64.1	97.0
	γ	17.2	29.2	64.5	97.2
	δ	10.6	18.3	44.3	94.6
below	α	7.9%	15.1%	40.0%	93.0%
	β	7.1	12.1	35.6	92.0
	γ	5.7	10.0	28.8	91.0
	δ	4.2	7.1	21.0	69.5

F) f-LOGS -- for the % in panel E

Father's occupation					
above	α	-.29	-.14	.41	1.75
	β	-.70	-.33	.29	1.74
	γ	-.78	-.45	.30	1.77
	δ	-1.07	-.75	-.12	1.44
below	α	-1.22	-.86	-.20	1.29
	β	-1.28	-1.00	-.30	1.22
	γ	-1.40	-1.10	-.45	1.16
	δ	-1.57	-1.29	-.66	.41

exhibit 4 (Cont'd.) - 3

G) ff-LOGS -- differences in f-logs

Father's occupation	Son's occupation α	β	γ	δ	(mean)
α	.93	.72	.61	.46	(.68)
β	.58	.67	.59	.52	(.59)
γ	.62	.65	.75	.61	(.66)
δ	.50	.54	.54	1.03	(.66)
(mean)	(.66)	(.64)	(.62)	(.66)	.65

H) ELEMENTARY ANALYSIS OF panel G -- by means, with median , polish, unit = 0.01 in matched ff-logs

					eff	fit
α	26	1	-4	-18	7	67
β	1	6	4	-2	-3	57
γ	0	-1	15	2	2	62
δ	-5	-5	1	51	-5	55
eff	0	4	-2	-3	60	
fit	60	64	58	57		

Hinges of residuals: -3 and +5. Clarity of fit = $\frac{19}{8}$ = 2h.
Outs: 4/16

I) SOURCE

Natalie Rogoff 1953. Recent Trends in Occupational Mobility. Glencoe; Free Press. (Esp. Table 2 on page 45.)

exhibit 5 of chapter 30z -- Indianapolis mobility

A simple diagonal analysis of the double flogs
(see exhibit 4)

A) OFF-DIAGONAL VALUES and FIT by MEDIAN DIFFERENCES -- unit 0.01 in matched fflogs

	double flogs				fit				residuals			
	α	β	γ	δ	α	β	γ	δ	α	β	γ	δ
α	a	72	61	46	60	66	62	52	.	6	-1	-6
β	58	a	59	52	58	64	60	50	0	.	-1	2
γ	62	65	a	61	64	70	66	56	-2	-5	.	5
δ	50	54	54	a	50	56	52	42	0	-2	2	.

B) DIAGONAL RESIDUE -- matched and raw

	matched fflogs				raw double flogs			
	α	β	γ	δ	α	β	γ	δ
α	33				29			
β		3				3		
γ			9				9	
δ				61				53

Examples: 33 = 93-60, 3 = 67-64, etc.
29 = 33/1.15, 3 = 3/1.15, etc.

Since we are dealing with double flogs, chapter 29x would lead us to look at the relation of double flogs to log smallest corners. Exhibit 6 shows that something is to be gained by taking out a tilt (the midspread shrinks from 15h to 8h), but that the diagonal residue is little affected.

Exhibit 7 admits more fully that the diagonal values may be different, omitting them from the calculation of tilt as well as from the columns-plus-rows fit to the residuals after tilt. The small diagonal values get smaller, the large get larger.

In all these analyses, column (or row) effects are small -- and irregular.

The appropriate summary, in order of importance, thus runs:

-- off-diagonal double flogs are near .58 (matched).

-- the two end diagonal values, between proprietors and semiprofessional on the one hand, and between unskilled and semiskilled on the other, are much larger, especially the latter (.93 and 1.03, matched).

-- the $\gamma\gamma$ diagonal value, between skilled and clerical, may also be larger than the off-diagonal background, but not by much.

-- effects of column and row are small and irregular.

exhibit 6 of chapter 30z -- Indianapolis mobility

Analysis in terms of log smallest corners

A) TILT REMOVAL from ALL -- units 0.01 in fflog (matched), 0.01 in log smallest corner

	fflog (matched)				log smallest corner				residual*			
	α	β	γ	δ	α	β	γ	δ	α	β	γ	δ
α	93	72	61	46	231	239	224	118	65	43	31	32
β	58	67	59	52	253	277	279	165	28	34	26	32
γ	62	65	75	61	242	287	299	185	33	31	39	39
δ	50	54	54	103	145	188	215	231	33	31	28	75

Hinges: 54 and 69h

Hinges: 30h and 39

*residual = fflog - .12(log smallest corner)

B) ANALYSIS of RESIDUALS -- by median polish

	analysis*					diagonal residue*			
	α	β	γ	δ	eff	α	β	γ	δ
α	25	2	-2	-11	6	25			
β	-1	4	0	0	-5		4		
γ	-2	-5	8	1	1			8	
δ	0	-3	-1	39	-1				39
eff	-1	2	-5	2	35				

median of off-diagonal residuals = -1

*of residuals in panel A

exhibit 6 (cont'd.)

C) ANALYSIS of OFF-DIAGONAL RESIDUALS -- by median polish

	analysis*					fit				diagonal residue*			
	α	β	γ	δ	eff	α	β	γ	δ	α	β	γ	δ
α	a	6	0	-6	6	39	37	34	38	26			
β	-3	a	0	3	-3	30	28	25	29		6		
γ	0	0	a	7	0	33	31	28	32			11	
δ	0	0	0	a	0	33	31	28	32				43
eff	1	-1	-4	0	32								

*of residuals in panel A

D) PROBLEMS

1) Show that analysis by median differences in panel B yields diagonal residuals of 25, 4, 7, and 39.

2) Show that analysis by median differences in panel C yields diagonal residuals of 29, 5, 9, and 43.

exhibit 7 of chapter 30z -- Indianapolis mobility

More careful analysis in terms of log smallest corner

A) OFF-DIAGONAL for TILT

	fflog (matched)				log smallest corner				residual*			
	α	β	γ	δ	α	β	γ	δ	α	β	γ	δ
α	a	72	61	46	a	239	224	118	(73)	52	42	36
β	58	a	59	52	253	a	279	165	36	(43)	35	38
γ	62	65	a	61	242	267	a	185	41	44	(47)	46
δ	50	54	54	a	145	188	215	a	38	38	36	(83)

Hinges: 53 and 61h.

Hinges of 12: 36 and 43.

*residual = fflog - .085(log smallest corner)

B) ANALYSIS of OFF-DIAGONAL RESIDUALS

						fit				diagonal residue			
	α	β	γ	δ	eff	α	β	γ	δ	α	β	γ	δ
α	abs	5	0	-4	4	44	47	42	42	29			
β	-2	abs	0	0	-2	38	41	36	36		2		
γ	0	0	abs	7	1	41	44	39	39			8	
δ	0	-3	0	abs	-2	28	41	36	36				47
eff	1	4	-1	-1	39								

* European mobility *

Since Rogoff's data covered a period of great change and development in Indianapolis, there is interest in looking at similar data for a less rapidly changing society. Exhibit 8 shows the results for Glass's data for Britain. A careful direct approach shows no serious need for a diagonal fit. Restoring the diagonal entries and reanalyzing leads to the final column-plus-row analysis, which leaves residuals with a midspread of no more than .04.

Exhibit 9 shows the two-way plot, calling our attention to the great similarity of the effects attached to father's cut and to son's cut. In England, over this time period, resistance to mobility -- if double flogs measure this -- seems to be very much a matter of position on the social class scale, equally for sons as for fathers.

This is quite a different picture that we found for the Indianapolis data. We leave to those expert about mobility the question of how this difference should be interpreted.

exhibit 8 of chapter 30z -- British mobility

Glass's data analyzed for a simple diagonal fit

A) COUNTS and, in 0.01, DOUBLE FLOGS

counts

Father's status	Son's status 1	2	3	4	5
1	50	45	8	18	8
2	28	174	84	154	55
3	11	78	110	223	96
4	14	150	185	714	447
5	3	42	72	320	411

double flogs			
157	122	100	81
116	80	74	65
87	72	63	55
86	67	53	50

B) OFF-DIAGONAL FIT

double flogs			
.	102	115	94
82	.	79	75
67	76	.	62
55	88	72	.

analysis				
.	19	0	-5	28
0	.	0	5	2
-4	0	.	0	-3
0	0	-11	.	-8
40	1	-2	-16	74

fit			
142	103	100	86
116	77	74	60
111	72	69	55
106	67	64	50

exhibit 8 (cont'd.)

C) RESIDUALS

diagonal					combined					inner analysis				
-15					15	19	0	-5		4	6	-5	-19	12
	3				0	3	0	5		-2	-1	4	0	3
		-6			-4	0	-6	0		-1	1	3	0	-2
			0		0	0	-11	0		2	0	-3	-1	-3
										-1	1	-7	2	0

D) FINAL ANALYSIS

4	6	-5	-19	40
-2	-1	4	0	1
-1	1	3	0	-5
2	0	-3	-1	-11
39	2	-9	-14	74

Hinges: -1h and 2h.

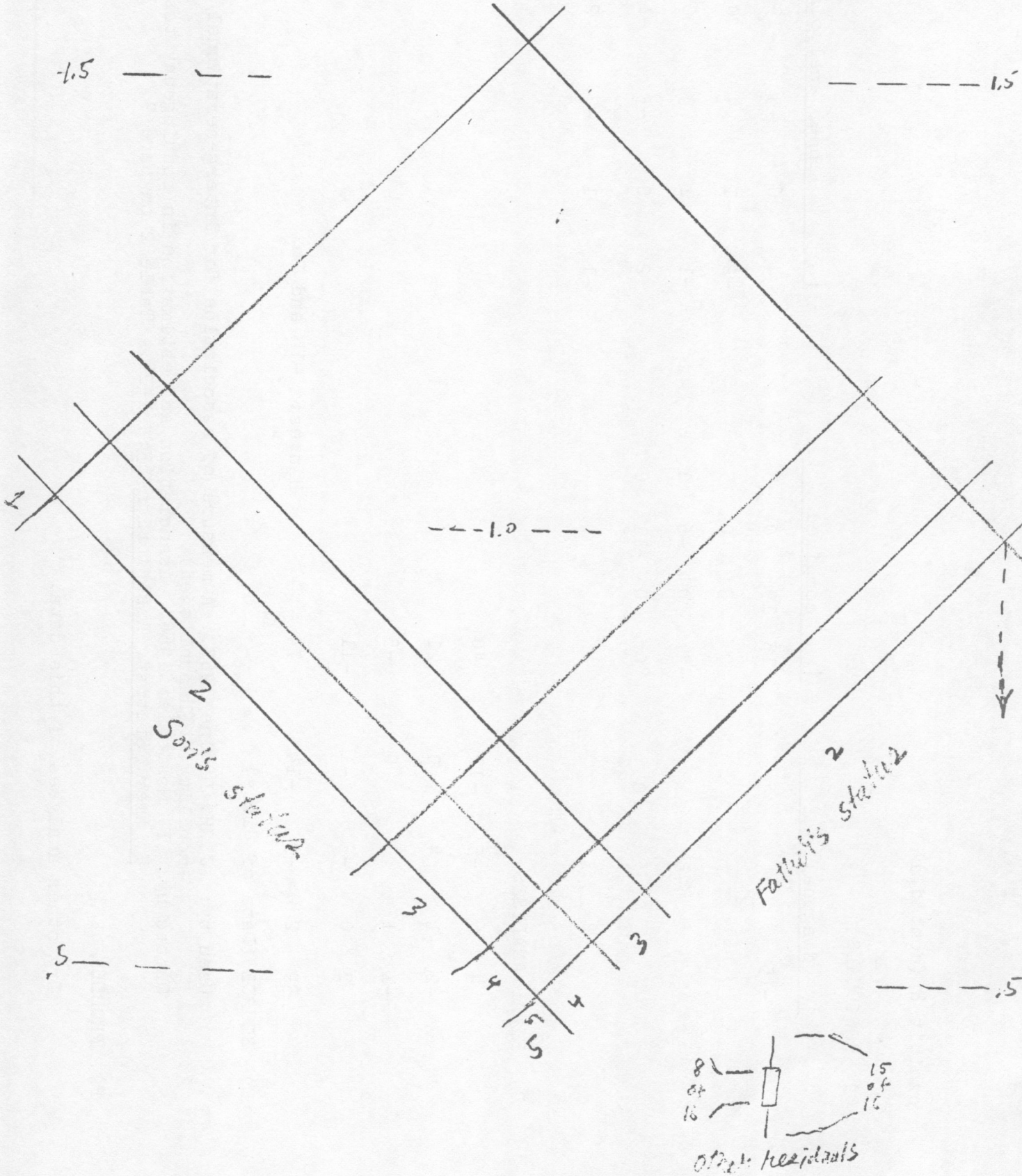
E) SOURCE (Data of Glass)

Used by: J. H. Levine 1967. A measure of association for intergenerational status mobility. (Unpublished)
Quoted by: F. Mosteller 1968. Association and estimation in contingency tables. J. Amer. Statist. Association 63: 1-28. Table 2 on page 9.

F) PROBLEM

Try other analyses of this data.

Glass's mobility data for Britain
Two-way plot of double flogs



****

30zH. How far have we come?

In this chapter we have found analyzing for a diagonal fit both simple and effective. The simple approach -- suppressing values on the diagonal, fitting the remainder (which automatically provides fits for the diagonal), and taking the diagonal residuals as the diagonal fit (or as a basis for the diagonal fit, we are fitting fewer constants) -- works clearly and well.

We can -- and should -- use a similar approach for any other special fitting which both:

-- extends beyond columns-plus-rows (or some other well-understood fitting).

-- affects the values fitted to only a minor part of the observations.

When the basic table is of double flogs, we can combine the fitting of a tilt on log smallest corner with diagonal fitting. (In our examples, the combination brought out little new, but this need not always be so.)

Data involving migration or mobility often stands in deep need of diagonal fitting.

****

30zP. Problems for chapter 30z

1. Do problem 1 of exhibit 1.

2. Do problem 2 of exhibit 1.

3. Do problem 1 of exhibit 3.

4. Do problem 2 of exhibit 3.

5. Do problem 1 of exhibit 6.

6. Do problem 2 of exhibit 6.

7. Do the problem of exhibit 8.

8. The more complete version of the 1940 occupational mobility counts of Rogoff 1953 is as in exhibit 10. Complete the calculations of exhibit 4 for this more detailed table.

9. Do the same for the calculations of exhibit 5.

10. Rogoff (1953) also gives counts for occupational mobility for sons observed in 1910. An extract is given as exhibit 11. Analyze the table. Compare with the 1940 results.

11. In 1953, Query 99 set out the data given in exhibit 12. Make a diagonal analysis. Comment.

12. In 1949, Kiser and Whelpton published the data in exhibit 13 on the extent of methods of fertility planning. Find ff-logs for at least one of the three tables. Make an elementary analysis.

13. Make a different analysis of the data analyzed in problem 11. Discuss the pros and cons of the two analyses.

14. Mosteller (see exhibit 8) also gave data of Svalostoga for Danish mobility as reported in exhibit 14. Analyze the double flogs as well as you can. Compare and contrast your results with both the Indianapolis (Rogoff) and British (Glass) examples.

15. Find a set of data that interests you that deserves diagonal analysis. Analyze it. Comment.

exhibit 10 of chapter 30z -- Indianapolis mobility

Indianapolis 1940 Occupational Mobility Counts

A) CUTTING POINTS

ω	Professional
α	Semi-professional
β	Proprietors, managers, and officials
γ	Clerical and sales
η	Skilled
δ	Semiskilled
	Unskilled

B) COUNTS -- rows are cuts for father's occupation

	Cut for son's occupation						
	ω	α	β	γ	η	δ	
ω	134	30	36	132	73	43	12
α	18	22	4	20	27	14	3
β	92	41	212	368	172	238	30
γ	84	57	83	461	165	179	26
η	89	78	117	520	880	734	154
δ	38	32	62	262	279	657	81
	17	11	20	94	111	216	206

exhibit 12 of chapter 30z

Before and after rating scales for 81 people

(Entries are counts)

same before	5 point rating scale after				
	not at all 1	a little 2	some 3	much 4	very much 5
1	4	0	0	0	0
2	0	3	2	0	0
3	3	5	17	3	2
4	0	2	8	10	0
5	2	0	3	6	11
((81))	(9)	(10)	(30)	(19)	(13)

Source. Query 99, 1953. Biometrics 9: 108-110.

exhibit 13 of chapter 30z

Economic status and family planning

in Indianapolis, 19

A) HUSBAND'S ANNUAL EARNINGS -- average since marriage

Earnings	% of "relatively sound couples"			
	# and spacing planned	planned	planned	excess
≥ $3000	45.5%	16.5%	23.1%	14.9%
$2000 - $2999	33.0	14.7	35.1	17.2
$1600 - $1999	30.1	14.0	35.3	20.6
$1200 - $1599	25.6	15.2	29.8	29.4
< $1200	16.2	11.1	30.3	42.4

B) RENT VALUE OF SHELTER -- at interview

Monthly Rent				
≥ $50	43.6%	15.4	24.4	16.5
$35 - $49	34.9	13.1	30.8	21.3
$25 - $34	26.5	13.6	34.7	25.2
$15 - $24	12.8	14.6	34.5	38.1
≤ $15	13.3	16.7	28.9	41.1

exhibit 13 (Cont'd)

C) NET WORTH OF FAMILY

Worth				
≥ $6000	49.5	19.9	20.9	9.7
$4000 - $5999	45.6	18.4	20.2	15.8
$2000 - $3999	30.2	12.8	32.4	24.6
$1000 - $1999	22.2	9.4	37.4	31.0
$200 - $999	25.4	12.1	38.1	24.4
$0 - $199	12.2	16.0	32.5	39.2
Net debt	11.7	13.8	27.7	46.8

D) SOURCE

C. V. Kiser and P. K. Whelpton 1949. Social and psychological factors affecting fertility. IX. Fertility planning and fertility rates by socio-economic status. Milbank Memorial Fund Quarterly 27: 188-244. (Pages 360 to 415 of reprint.) Table 5 on page ??? (page 385 of reprint).

exhibit 14 of chapter 30z -- Danish mobility

Similar analysis for European mobility

A) COUNTS, ffLOGS, and log SMALLEST CORNERS -- units 0.01 (except counts)

	counts					fflogs				log sm. cor.			
	1	2	3	4	5								
1	18	17	16	4	2	124	102	115	94	126	134	78	30
2	42	122	125	63	23	82	90	79	75	157	222	193	136
3	65	206	414	280	118	67	76	74	62	115	185	250	207
4	73	255	589	628	316	55	88	72	63	78	115	192	239
5	79	263	658	829	562								